

An Airborne Continuous Flow Diffusion Chamber for Measuring Ice Nucleating Particles, Phase I

Completed Technology Project (2018 - 2019)



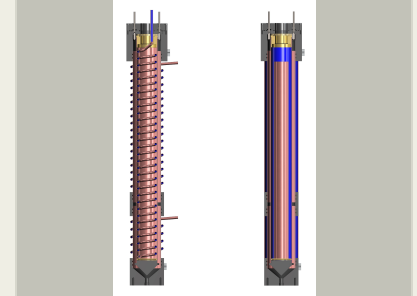
Project Introduction

Quantifying atmospheric aerosol, clouds and precipitation processes are critical needs for understanding climate and environmental change, a NASA objective. The formation of ice in the atmosphere depends on the nature and abundance of ice nucleating particles (INP), and has major implications for precipitation and cloud properties. Observational capabilities are required to advance understanding of INP, and there is a substantial gap between current needs within NASA and existing instruments. This project develops a new commercial instrument for airborne INP measurements based on the continuous flow diffusion chamber (CFDC) concept. The CFDC approach involves exposing sampled aerosol in a region between two ice-covered walls and measuring ice crystals that form. In Phase I, we seek to test new wall materials necessary for wider-spread use and commercialization of the CFDC technology. Wall materials used in current versions of the CFDC require frequent cleaning, chemical treatment, and re-assembly, which makes its use by NASA prohibitively costly. Tests proposed include characterizing the thermal and other properties of the proposed wall materials, assessing their performance in terms of INP measurement sensitivity when applied in a basic laboratory configuration, and evaluating their longevity and stability necessary for use in a sustainable measurement platform. An evaluation of the test results will identify a suitable wall material for future development efforts would be the of Phase II, which has the deliverable of producing a prototype INP measurement system suitable for autonomous operation onboard research aircraft. The project directly addresses the NASA need for measurement capabilities to support current satellite and model validation by providing an instrument capable of measuring ice nucleating particle concentration in an airborne deployment, as identified in subtopic S1.08, In Situ Sensors and Sensor Systems for Earth Science.

Anticipated Benefits

By supporting this project, NASA would obtain airborne INP measurement capabilities that would support model validation and airborne science program field campaigns, similar to those discussed in the ROSES-2018 solicitation. Suitable platforms include the DC-8, P-3, C-20A and G-V. Relevant campaigns include any that include a focus on aerosol-cloud interactions, similar to FIREChem, NAAMES, ORACLES, ARISE II, CAMP2Ex and potentially those funded by the currently open EVS-3 solicitation.

Domestically, agencies with an interest in measuring INP from aircraft include the Department of Energy ASR/ARM, NOAA CSD, and NSF/NCAR atmospheric chemistry programs. Foreign government organizations include the UK MetOffice (BAe-146) and German DLR (G-V). Handix Scientific also has a close connection with investigators internationally because its owner is an atmospheric research instrument distributor for several US-based companies, and we anticipate interest from this emerging community.



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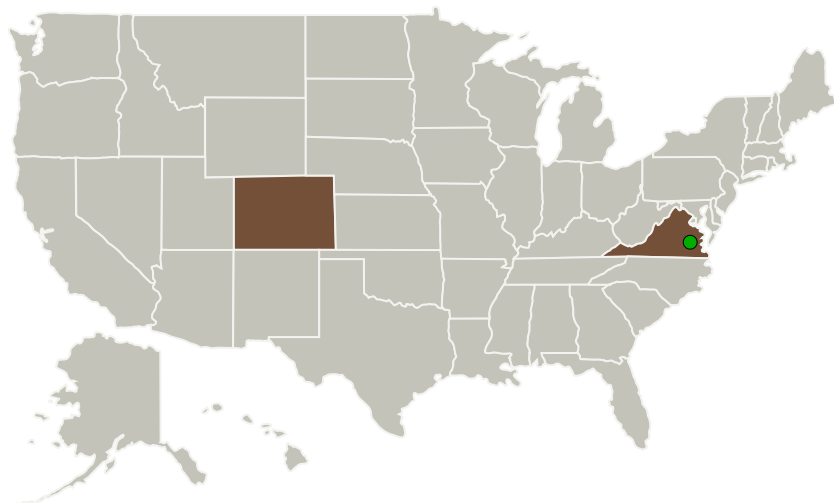
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Handix Scientific, LLC	Lead Organization	Industry	Boulder, Colorado
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations

Colorado	Virginia
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Project Transitions

**July 2018:** Project Start**February 2019:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140925>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Handix Scientific, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

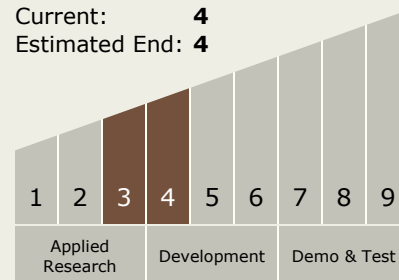
Carlos Torrez

Principal Investigator:

Gavin Mcmeeking

Technology Maturity (TRL)

Start: **3**
 Current: **4**
 Estimated End: **4**

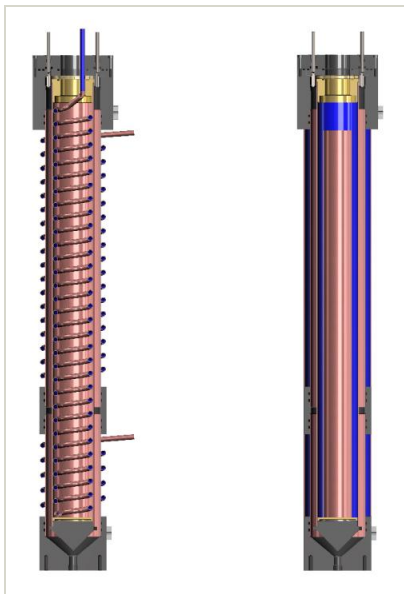


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Images



Briefing Chart Image

An Airborne Continuous Flow
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(<https://techport.nasa.gov/image/135208>)



Final Summary Chart Image

An Airborne Continuous Flow
Diffusion Chamber for Measuring
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(<https://techport.nasa.gov/image/130924>)

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves

Target Destination

Earth